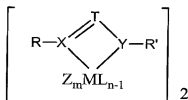
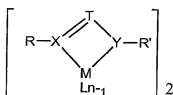
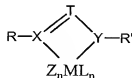
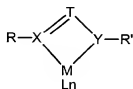


**CLAIMS:**

1. A catalyst precursor composition represented by one or more:



wherein T is a bridging group containing 2 or more bridging atoms;

M is a metallic element selected from Groups 1 to 15, and the Lanthanide series of the Periodic Table of the Elements,

Z is a coordination ligand;

each L is a monovalent, bivalent, or trivalent anionic ligand;

n is an integer from 1 to 6;

m is an integer from 1 to 3;

X and Y are heteroatoms each independently selected from nitrogen, oxygen, sulfur, and phosphorus;

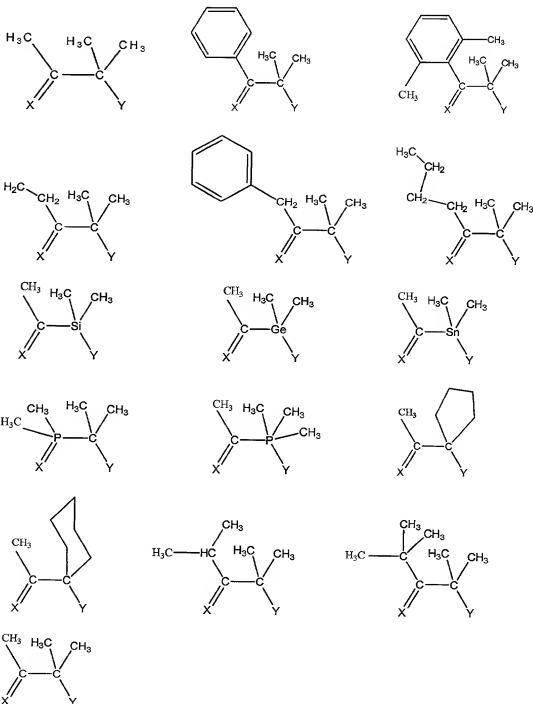
R is a non-bulky substituent that has relatively low steric hindrance with respect to X; and

R' is a bulky substituent that is sterically hindering with respect to Y.

2. The catalyst precursor composition of claim 1 wherein T contains 2 or 3 bridging atoms and from about 2 to 50 non-hydrogen atoms, at least one of which is a Group 14 atom.

3. The catalyst precursor composition of claim 1 wherein T contains at least two primary alkyl groups on the atom adjacent to Y.

5. The catalyst precursor composition of claim 1 wherein T is selected from:



wherein X and Y are provided for convenience and are not part of the bridging group.

6. The catalyst precursor of claim 1 wherein Z is selected from at least one of triphenylphosphine, tris(C<sub>1</sub>-C<sub>6</sub> alkyl) phosphine, tricycloalkyl phosphine, diphenyl alkyl phosphine, dialkyl phenyl phosphine, trialkylamine, arylamine, a substituted or unsubstituted C<sub>2</sub> to C<sub>20</sub> alkene, an ester group, a C<sub>1</sub> to C<sub>4</sub> alkoxy group, an amine group, carboxylic acid, and di(C<sub>1</sub> to C<sub>3</sub>) alkyl ether, an an  $\eta^4$ -diene, tetrahydrofuran, and a nitrile.

7. The catalyst precursor of claim 1 wherein each L is an anionic ligand independently selected from those containing from about 1 to 50 non-hydrogen atoms and selected from the group comprised of halogen containing groups; hydrogen; alkyl; aryl; alkenyl; alkylaryl; arylalkyl; hydrocarboxy; amides, phosphides; sulfides; silyalkyls; diketones; borohydrides; and carboxylantes.

8. The catalyst precursor of claim 1 wherein each L is an anionic ligand independently selected from those containing from about 1 to 20 non-hydrogen atoms and selected from the alkyl, arylalkyl, and halogen containing groups.

9. The catalyst precursor of claim 1 wherein n is an integer from 1 to 4.

10. The catalyst precursor of claim 1 wherein both X and Y are nitrogen.

11. The catalyst precursor of claim 1 wherein R is a non-bulky substituent selected from straight and branched chain alkyl groups.

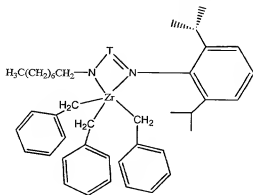
12. The catalyst precursor of claim 11 wherein R is a C<sub>1</sub> to C<sub>10</sub> straight chain alkyl group.

13. The catalyst precursor of claim 1 wherein R' contains from about 3 to 50 non-hydrogen atoms and be selected from alkyl, alkenyl, cycloalkyl, heterocyclic (both heteroalkyl and heteroaryl), alkylaryl, arylalkyl, polymeric, and inorganic ring moieties.

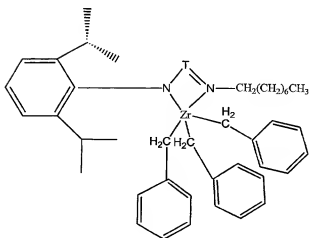
14. The catalyst precursor of claim 13 wherein R' contains from about 4 to 20 non-hydrogen atoms.

15. The catalyst precursor of claim 16 wherein the R' substituent has one or more of its carbon or hydrogen positions substituted with an element selected from Groups 14 to 17 of the Periodic Table of the Elements, other than carbon.

16. The catalyst precursor of claim 1 having a formula selected from:



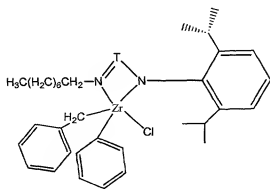
, and



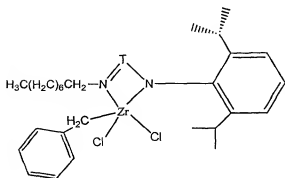
wherein T is a bridging group containing 2 or more bridging atoms.

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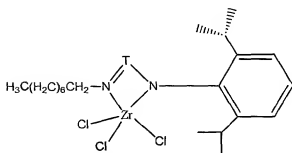
17. The catalyst precursor of claim 1 which is represented by a formula selected from:



and



and

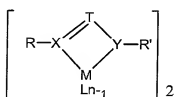
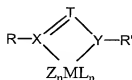
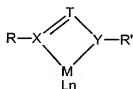


wherein T is a bridging group containing 2 or more bridging atoms.

18. The catalyst precursor composition of claim 1 wherein M is selected from Groups 3 to 7 of the Periodic Table of the Elements.

19. A catalyst composition comprising:

a) a catalyst precursor represented by one of the formulae selected from:



wherein T is a bridging group containing 2 or more bridging atoms;

M is a metallic element selected from Groups 1 to 15, and the Lanthanide series of the Periodic Table of the Elements,

Z is a coordination ligand;

each L is a monovalent, bivalent, or trivalent anionic ligand;

n is an integer from 1 to 6;

m is an integer from 1 to 3;

X and Y are heteroatoms each independently selected from nitrogen, oxygen, sulfur, and phosphorus;

R is a non-bulky substituent that has relatively low steric hindrance with respect to X; and

R' is a bulky substituent that is sterically hindering with respect to Y; and

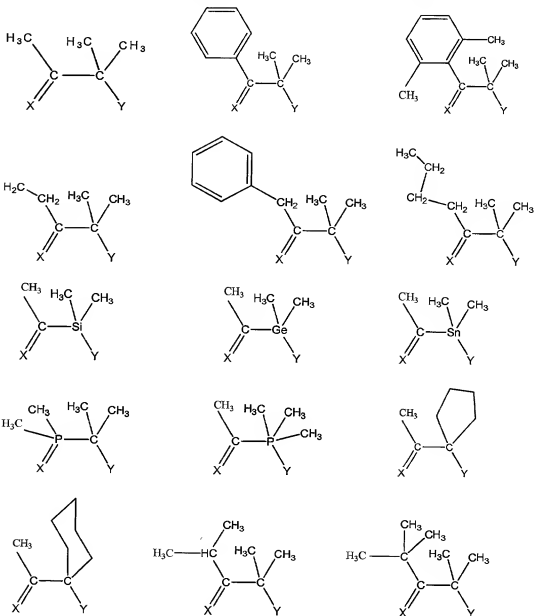
b) an activating cocatalyst.

20. The catalyst composition of claim 19 wherein T contains 2 or 3 bridging atoms and from about 2 to 50 non-hydrogen atoms, at least one of which is a Group 14 atom.

21. The catalyst composition of claim 19 wherein T contains at least two primary alkyl groups on the atom adjacent to Y.

22. The catalyst composition of claim 19 wherein T contains a dimethyl group adjacent to Y.

23. The catalyst composition of claim 19 wherein T is selected from:





wherein X and Y are provided for convenience and are not part of the bridging group.

24. The catalyst composition of claim 19 wherein Z is selected from at least one of triphenylphosphine, tris(C<sub>1</sub>-C<sub>6</sub> alkyl) phosphine, tricycloalkyl phosphine, diphenyl alkyl phosphine, dialkyl phenyl phosphine, trialkylamine, arylamine, a substituted or unsubstituted C<sub>2</sub> to C<sub>20</sub> alkene, an ester group, a C<sub>1</sub> to C<sub>4</sub> alkoxy group, an amine group, carboxylic acid, and di(C<sub>1</sub> to C<sub>3</sub>) alkyl ether, an an  $\eta^4$ -diene, tetrahydrofuran, and a nitrile.

25. The catalyst composition of claim 19 wherein each L is an anionic ligand independently selected from those containing from about 1 to 50 non-hydrogen atoms and selected from the group comprised of halogen containing groups; hydrogen; alkyl; aryl; alkenyl; alkylaryl; arylalkyl; hydrocarboxy; amides, phosphides; sulfides; silyalkyls; diketones; borohydrides; and carboxylantes.

26. The catalyst composition of claim 19 wherein each L is an anionic ligand independently selected from those containing from about 1 to 20 non-hydrogen atoms and selected from the alkyl, arylalkyl, and halogen containing groups.

27. The catalyst composition of claim 19 wherein n is an integer from 1 to 4.

28. The catalyst composition of claim 19 wherein both X and Y are nitrogen.

29. The catalyst composition of claim 19 wherein R is a non-bulky substituent selected from straight and branched chain alkyl groups.

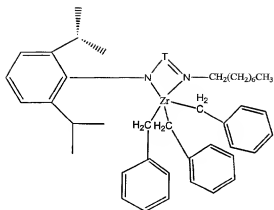


- DOE** Department of Energy **FE** Energy Efficiency **FD** Energy Efficiency



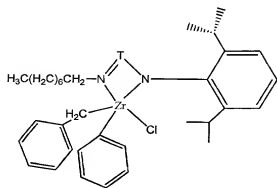
**DOE** Department of Energy **FE** Energy Efficiency **FD** Energy Efficiency

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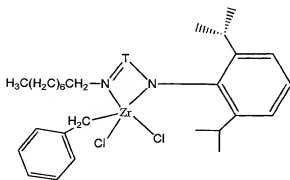


wherein T is a bridging group containing 2 or more bridging atoms.

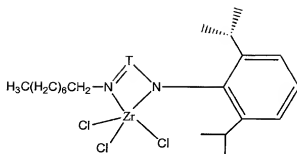
35. The catalyst precursor of claim 19 which is represented by a formula selected from:



and



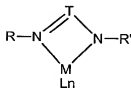
and



wherein T is a bridging group containing 2 or more bridging atoms.

36. The catalyst precursor composition of claim 19 wherein M is selected from Groups 3 to 7 of the Periodic Table of the Elements.

37. A catalyst precursor selected from the group consisting of those represented by:



wherein T is a bridging group containing less than 10 non-hydrogen atoms, at least 2 of which are linking atoms with respect to the nitrogen atoms and wherein at least one of the bridging atoms is a carbon atom;

M is selected from Hf and Zr;

each L is a ligand containing from about 1 to 20 non-hydrogen atoms and is selected from the group consisting of alkyl, arylalkyl and halogen containing groups;  
n is an integer from 1 to 3;

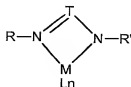
R is a non-bulky substituent selected from the C<sub>1</sub> to C<sub>10</sub> straight chain alkyl groups;  
and

R' is a bulky substituent that is sterically hindering with respect to which it is bonded and contains 4 to 20 non-hydrogen atoms and is selected from alkyl, alkenyl, cycloalkyl, heterocyclic, alkylaryl, and arylalkyl groups.

38. The catalyst precursor composition of claim 37 wherein T contains at least two primary alkyl groups on the atom adjacent to Y.

39. The catalyst precursor composition of claim 38 wherein T contains a dimethyl group adjacent to the nitrogen group bonded to R'.

40. A catalyst composition for the polymerization of olefins which catalyst composition is the reaction product of:



wherein T is a bridging group containing less than 10 non-hydrogen atoms, at least 2 of which are linking atoms with respect to the nitrogen atoms and wherein at least one of the bridging atoms is a carbon atom;

M is selected from Hf and Zr;

each L is a ligand containing from about 1 to 20 non-hydrogen atoms and is selected from the group consisting of alkyl, arylalkyl and halogen containing groups;  
n is an integer from 1 to 3;

R is a non-bulky substituent selected from the C<sub>1</sub> to C<sub>10</sub> straight chain alkyl groups;  
and

R' is a bulky substituent that is sterically hindering with respect to which it is bonded and contains 4 to 20 non-hydrogen atoms and is selected from alkyl, alkenyl, cycloalkyl, heterocyclic, alkylaryl, and arylalkyl groups.

41. The catalyst precursor composition of claim 40 wherein T contains a dimethyl group adjacent to the nitrogen group bonded to R'.